

State Water Survey Division

SURFACE WATER SECTION

AT THE

UNIVERSITY OF ILLINOIS

ENR

Illinois Department of
Energy and Natural Resources

SWS Contract Report 281

SEDIMENTATION SURVEY OF THE LAKE OF THE WOODS

MAHOMET, ILLINOIS

by

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Champaign Illinois



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Introduction

The Illinois State Water Survey has performed a sedimentation survey of the Lake of the Woods, a recreational facility owned by the Champaign County Forest Preserve District. The results of the August 1980 survey are summarized in this report.

Field data for the 1980 survey were collected by Water Survey personnel with the assistance of employees from the Forest Preserve District. Office calculations for water and sediment volumes were made by Water Survey personnel. Grain size analyses of sediment samples were performed by the Sediment Laboratory of the Water Survey.

General Information

Reservoir Location. Lake of the Woods is located on a tributary to the Sangamon River. The dam is about 1 mile east of the Village of Mahomet, Illinois in T.20N, R.7E., Sec. 14, in Champaign County, Illinois. The location of the reservoir is shown in figure 1.

History of the Reservoir. Work was initiated on a dam at the Lake of the Woods site in 1947. Two local landowners, Olen Parkhill and Don Keene constructed the dam with the intention of selling building lots or building a private resort on the banks of the 14.6 acre lake. Instead, the property was purchased in 1948 by the Champaign County Forest Preserve District along with 300 acres of adjoining land. The Forest Preserve District began a development program for the area and within two years had built Lake of the Woods Park, Champaign County's first county park.

In 1952, the District raised the water level of the lake 5 feet by building up the dam and spillway. This increased the area of the lake to 25 acres, about 3 acres of which are on property owned by the Champaign

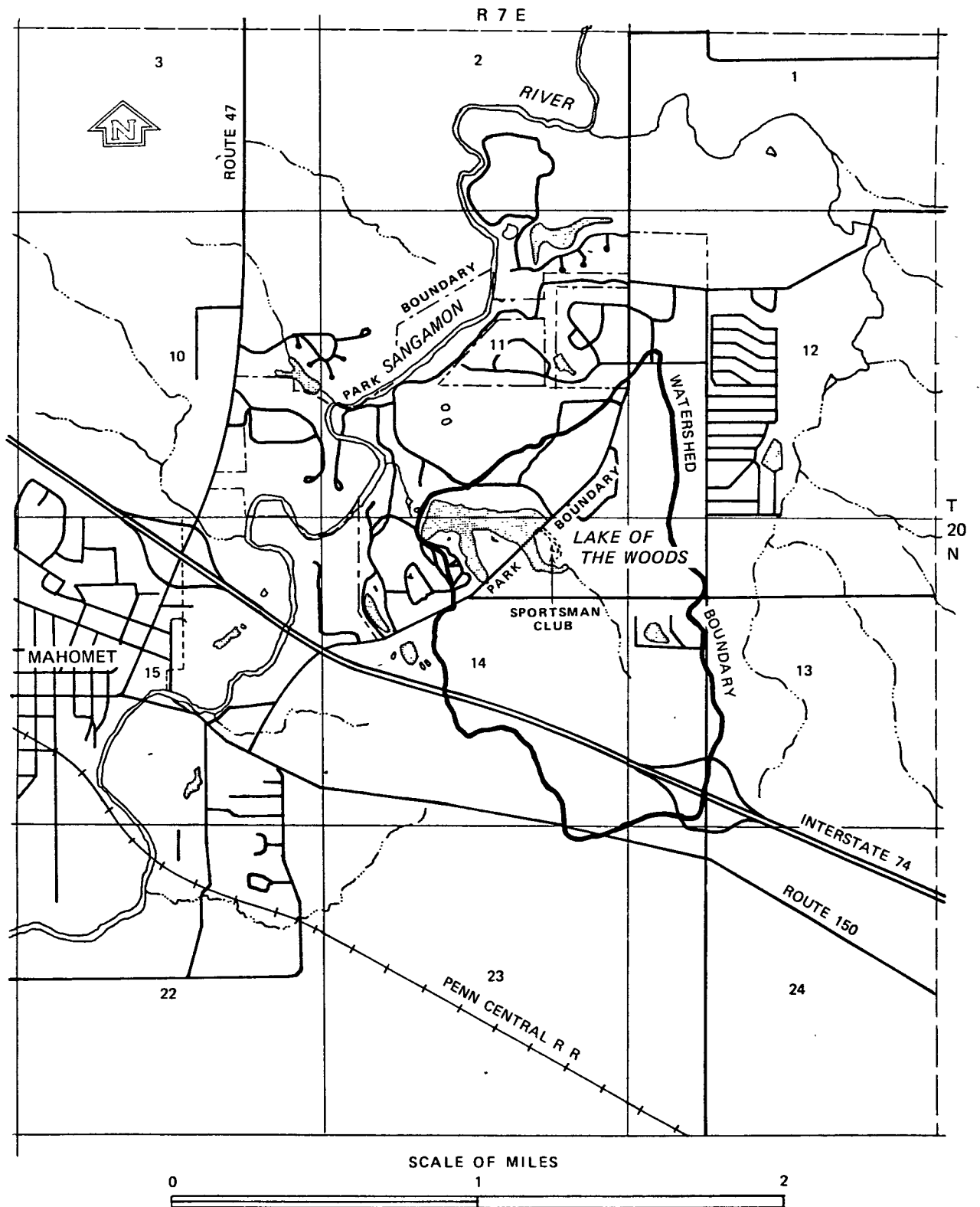


Figure 1. Watershed and location map of Lake of the Woods

County Sportsman's Club. An additional increase in the spillway level was made in 1954 when a 1.5 foot flashboard was installed.

Areas in the upper ends of the lake have been dredged on two occasions. Once, on an undetermined date, the Sportsman's Club had their portion of the north branch of the lake dredged. According to verbal description, a dragline was positioned on the road culvert separating the Club's property from the park and the upstream portion of the lake \was dredged to the farthest reach of the dragline, about 40 to 50 feet above the boat dock. More recently, the upper end of the south branch of the lake was dredged in 1979 by another private property owner.

The integrity of the dam has been imperiled twice over the years, once by wind-wave action and once by burrowing animals. However, prompt action by the district has prevented any extensive damage to the structure.

Spillway crest elevation of the lake is 710 feet above mean sea level (msl) according to the U.S. Geological Survey (USGS) topographic maps.

Watershed. The watershed of the lake (figure 1) has been heavily developed since the original construction of the lake. Development has included residential construction activities throughout the life of the lake and the construction of Interstate 74 in the early 1960's. Much of the area is still devoted to agricultural uses.

Sedimentation Survey

During the survey, 10 cross sections of the reservoir were established, mapped, and monumented, and sounding data were collected. The ends of the ranges were monumented with concrete posts set with about 1 foot of the post above land surface. The locations of these cross sections are shown in figure 2.

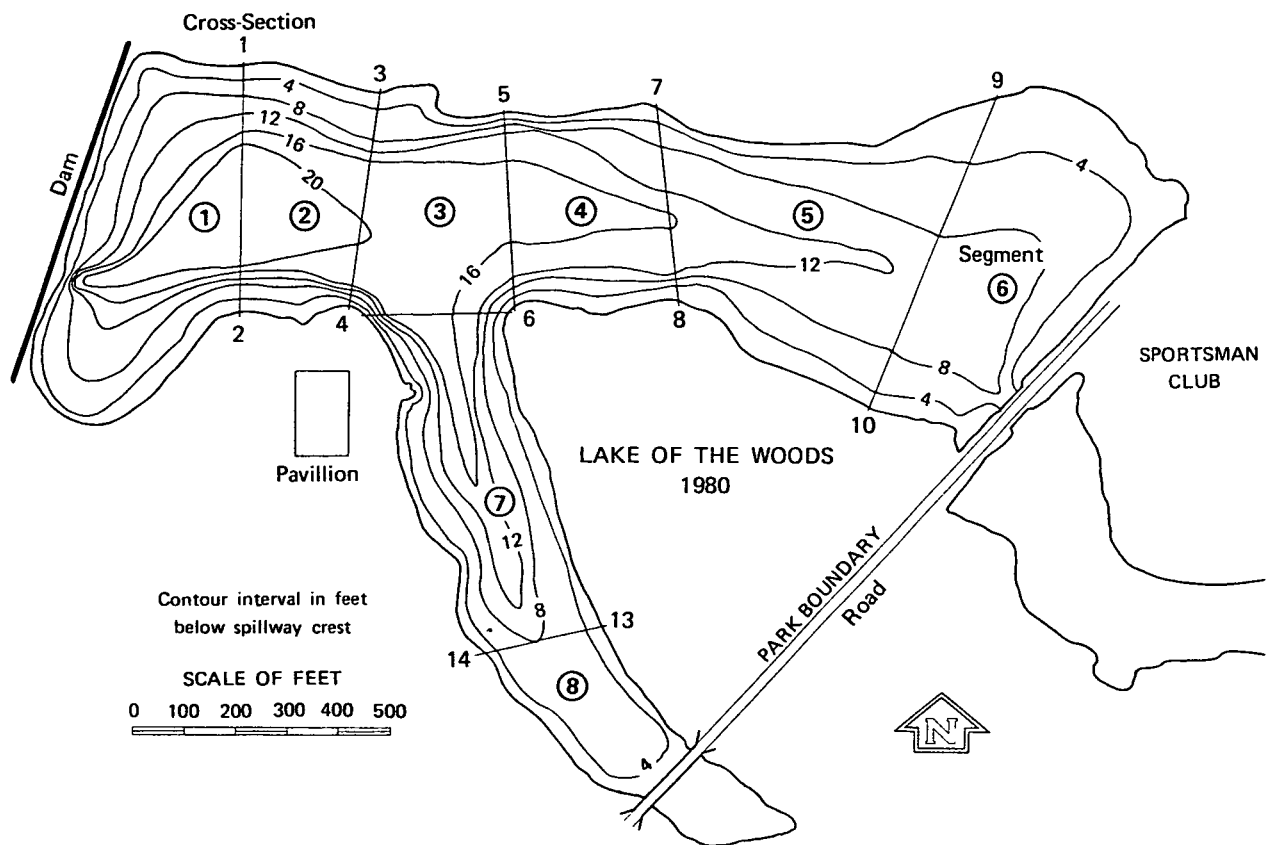


Figure 2. Map showing survey layout and bottom contours for Lake of the Woods, 1980

In the survey, sounding data were collected at 25-foot intervals on each cross section to measure both the original and the present depths of water in the lake below the spillway elevation. All depth measurements were made with a 2-inch diameter aluminum pole marked in tenths of feet. The pole was first lowered until it touched the present lake bottom and a depth measurement was made. The pole was then pushed through the accumulated sediment until it hit the solid original lake bed where another depth measurement was made. Horizontal control on each cross section was maintained with a marked plastic cable.

Samples of the accumulated sediment were collected during the survey for determining grain size distribution and unit weight.

Results

The sounding data from the survey were used to determine the 1948 capacity of the reservoir and the 1980 water and sediment volumes of the reservoir.

Volume calculations were made by the methods outlined in the Soil Conservation Service (SCS) National Engineering Handbook (1968). Volumes were determined by both the range and the contour methods. Average unit weight of the sediment samples collected at the time of the survey was 37.3 pounds per cubic foot. This value was used to compute the dry weight of the deposited sediment.

The results of the survey are presented in Table 1. As of August 1980, the lake had lost 13.5% of its 1948 volume to sedimentation. Average annual rate of capacity loss is 0.42%. If this rate is continued, the lake will have lost half of its original capacity by 2067 and would be completely filled by 2186. However, the ultimate life of the lake will

Table 1. Summary of Sedimentation Data
Lake of the Woods

<u>Age</u>	Years		
Built 1948			
1980	32		
<u>Watershed</u>	Sq mi	Acres	
Total area	1.00	640	
Area excluding lake	0.96	617	
<u>Reservoir</u>			
	Acres		
Surface area at spillway level	23.2		
Storage capacity at spillway level	Acre-feet	Mil gal	
1948	259.7	84.6	
1980	224.6	73.2	
Capacity per square mile of drainage area*	Acre-feet		
1948	259.7		
1980	224.6		
Sedimentation	Acre-feet		
1948-1980	35.1		
<u>Average annual accumulation of sediment**</u>			
	Acre-feet from entire watershed		
1948-1980	1.10		
	Acre-feet per square mile		
1948-1980	1.14		
	Cubic feet per acre		
1948-1980	77.8		
	Tons per acre		
1948-1980	1.45		
<u>Depletion of original storage</u>	Percent of original storage	Percent per year	
1948-1980	13.5	0.42	

* Includes area of lake

** Excludes area of lake

probably be considerably longer than this because with reduced retention time in the then smaller lake, the trap efficiency of the lake will also be significantly reduced.

The areal distribution of the deposited sediment in the lake is shown in Table 2. This table shows the volume changes and loss rates for different segments of the lake delineated by the survey lines. These segments are shown in figure 2. The loss rates indicate that the largest sediment deposition was in the headwaters of the reservoir where the sediment laden waters from the streams are first slowed by the impounded water.

Only one cross section was surveyed for the portion of the lake on the property of the Sportsman's Club. This information is insufficient for use in determining volumes in that segment. Therefore, only a rough estimate of the sedimentation rate is given. This rate of 1.4% per year is much higher than the rate for the lake as a whole. The probable cause of this higher rate is the excess deposition of sediment in the second pool created by the constricting culvert at this location (figure 2).

A 1980 depth contour map of the lake is shown in figure 2. This map was used to develop the stage-volume-area curves shown in figure 3. These curves can be used to determine the volume and area of the lake for any drawdown below the spillway crest for the conditions present in 1980. With continuing sedimentation, the map and the graph shown in figures 2 and 3 respectively, will no longer be valid.

The area and volume of the lake were calculated by the range and contour methods described in the SCS Engineering Handbook (1968). Tables 1 and 2 were compiled using the results from the range method calculations and figures 2 and 3 using the results from the contour method calculation.

Table 2. Summary of Sedimentation Data for
Lake of the Woods by Segments

Segment*	Volume (ac-ft)		Loss of original capacity		Weight of sediment (tons)
	1948	1980	% of total	%/yr	
1	61.8	55.8	9.8	0.31	3,450
2	34.3	30.3	11.7	0.36	2,300
3	40.0	34.5	13.8	0.43	3,953
4	28.6	24.3	15.0	0.47	3,091
5	38.6	33.4	13.5	0.42	3,953
6	16.0	13.8	13.8	0.43	1,854
7	35.0	28.7	18.0	0.56	7,862
8	<u>5.4</u>	<u>3.8</u>	29.6	0.93	<u>1,997</u>
Total	259.7	224.6			28,460
Percentages of total			13.5	0.42	
Sportsman's Club (age 30 years)			41.0	1.37	

*refer to figure 2 for locations of segments

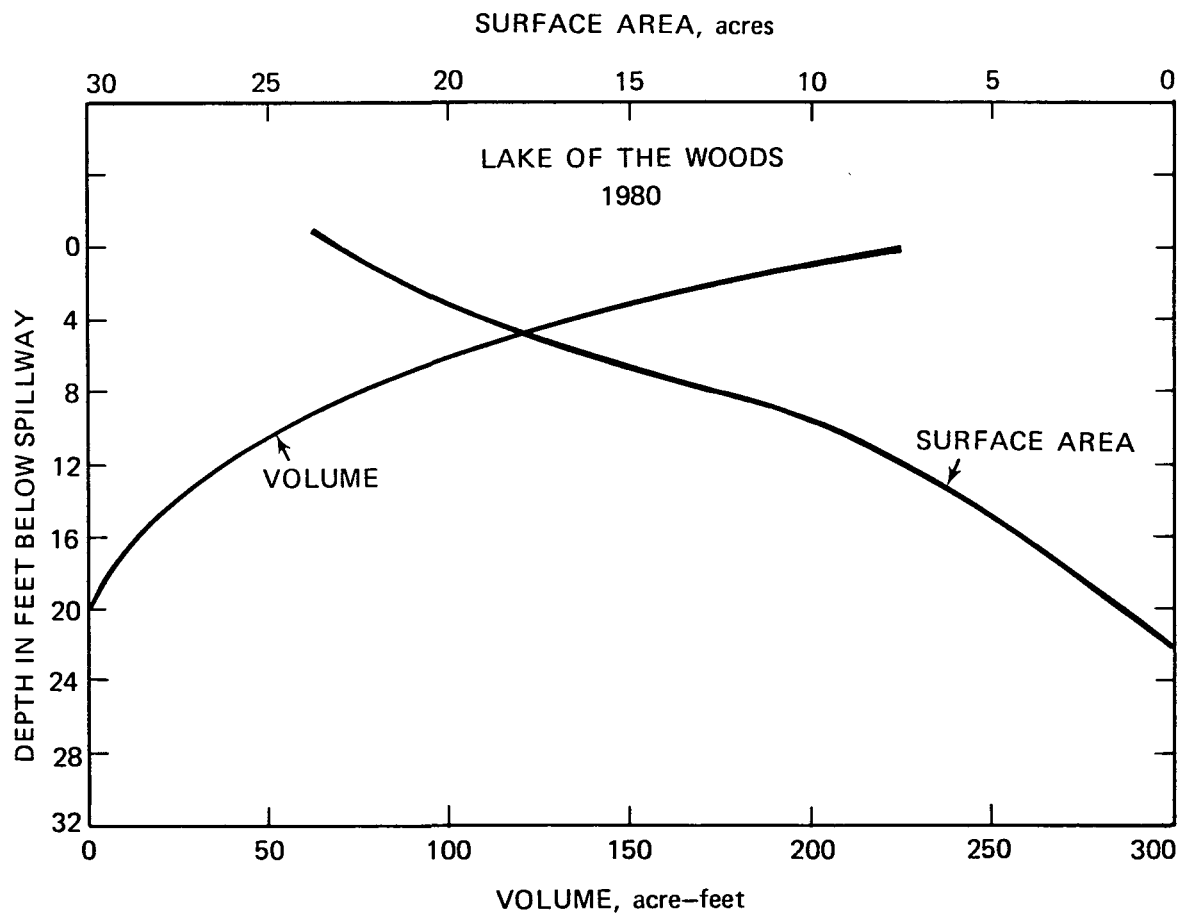


Figure 3. Stage-Volume-Area Curves for Lake of the Woods, 1980

Because of minor discrepancies in the maps used and inherent differences in the two calculation techniques, the areas and volumes determined by the two methods differ by 1%. The volume difference is well within the tolerances of these two calculations and should have no effect on the sedimentation rates determined.

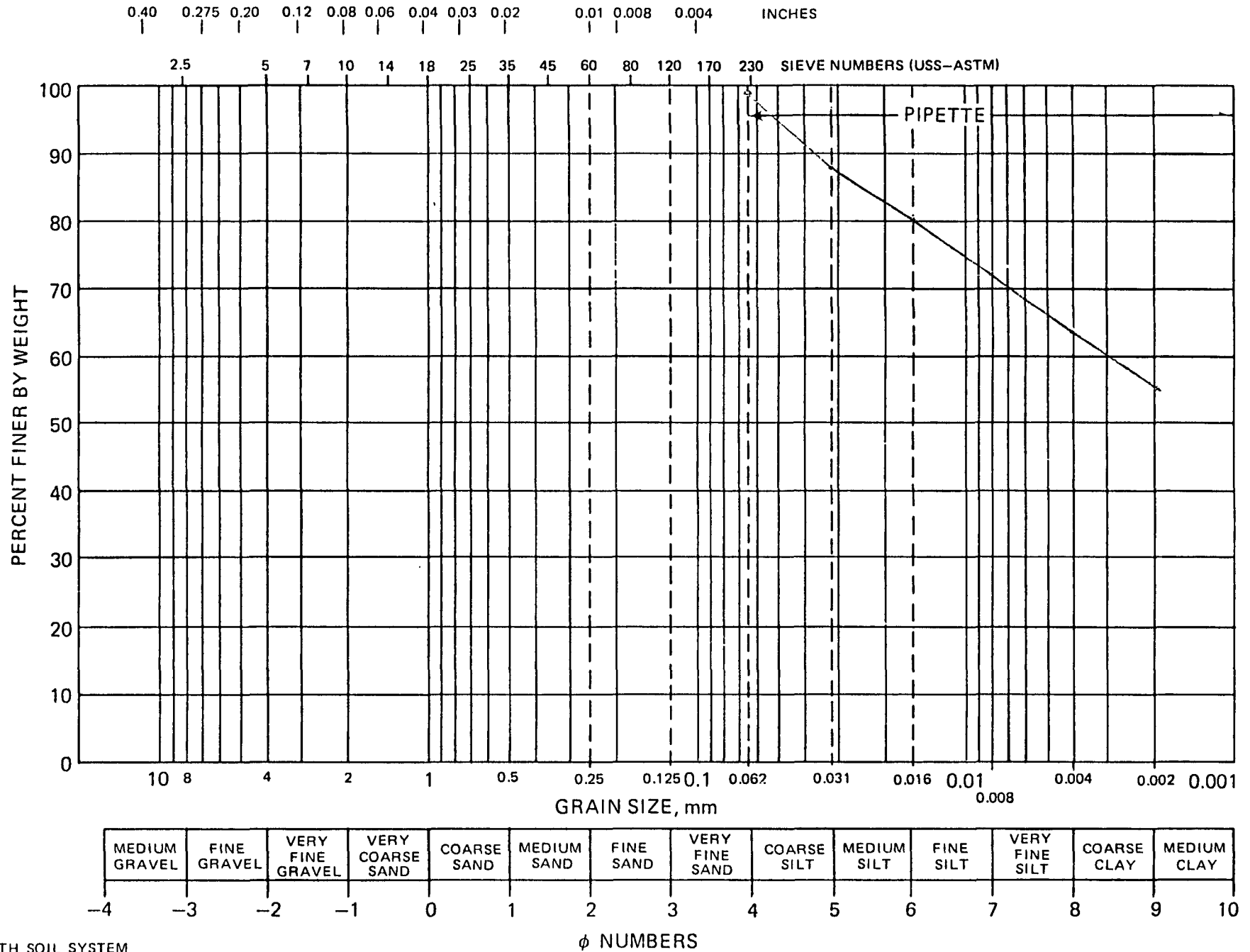
Summary

A sedimentation survey of the Lake of the Woods was conducted in August 1980. Data analyzed showed that the lake has been losing its storage capacity at the rate of 0.42% per year. Heavy sedimentation was observed to occur in the headwater tributaries of the lake. Segmental capacity loss was also calculated. A stage-area-volume relationship has been developed based on the 1980 data.

References

"Sedimentation," Soil Conservation Service, National Engineering Handbook, Section 3, Chapters 1, 2, and 7, March 1968.

ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY



WENTWORTH SOIL SYSTEM

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GILSON SCREEN/SIEVE TEST REPORT

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RETAINED							PASSING			NOTES	
WEIGHTS in. g kg Lb				PERCENT			SCREEN/SIEVE	WEIGHT	PERCENT		
Sample + Screen	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	SIZE OR RANGE	Cumulative	Cumulative		Spec
							<0.075	98.98			1
							<0.150	97.90			2
							<0.300	96.09			3
							<0.600	91.71			4
							<1.180	67.59			5
							<2.000	55.20			6
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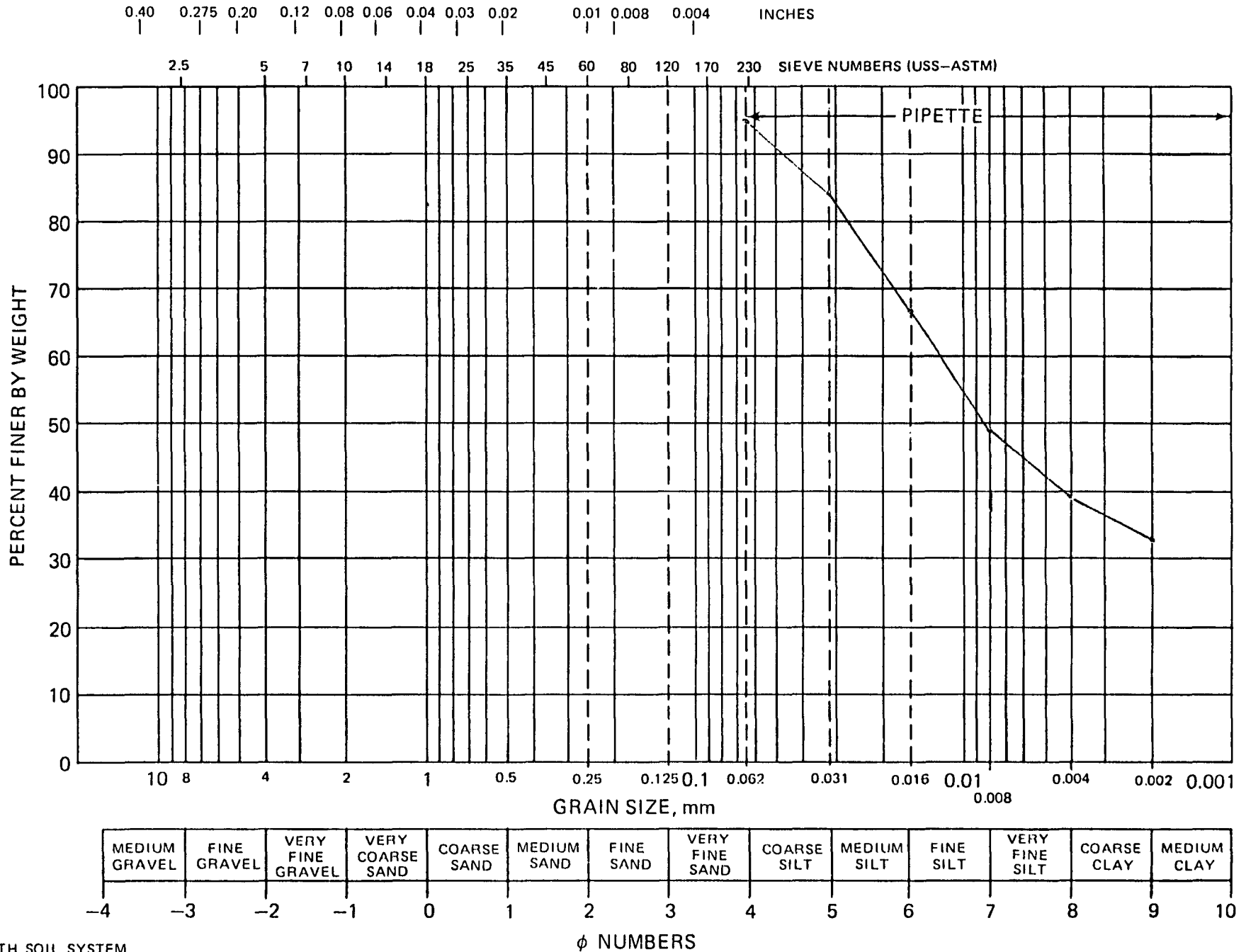
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GILSON SCREEN/SIEVE TEST REPORT

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RETAINED							PASSING			NOTES
WEIGHTS in. g kg lbs			PERCENT				SCREEN/SIEVE	WEIGHT	PERCENT	
Sample	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	SIZE OR RANGE	Cumulative	Cumulative	Spec
							<0.075	94.99		1
							<0.150	24.50		2
							<0.300	16.16		3
							<0.600	49.16		4
							<1.18	21.16		5
							<2.00	5.15		6
										7
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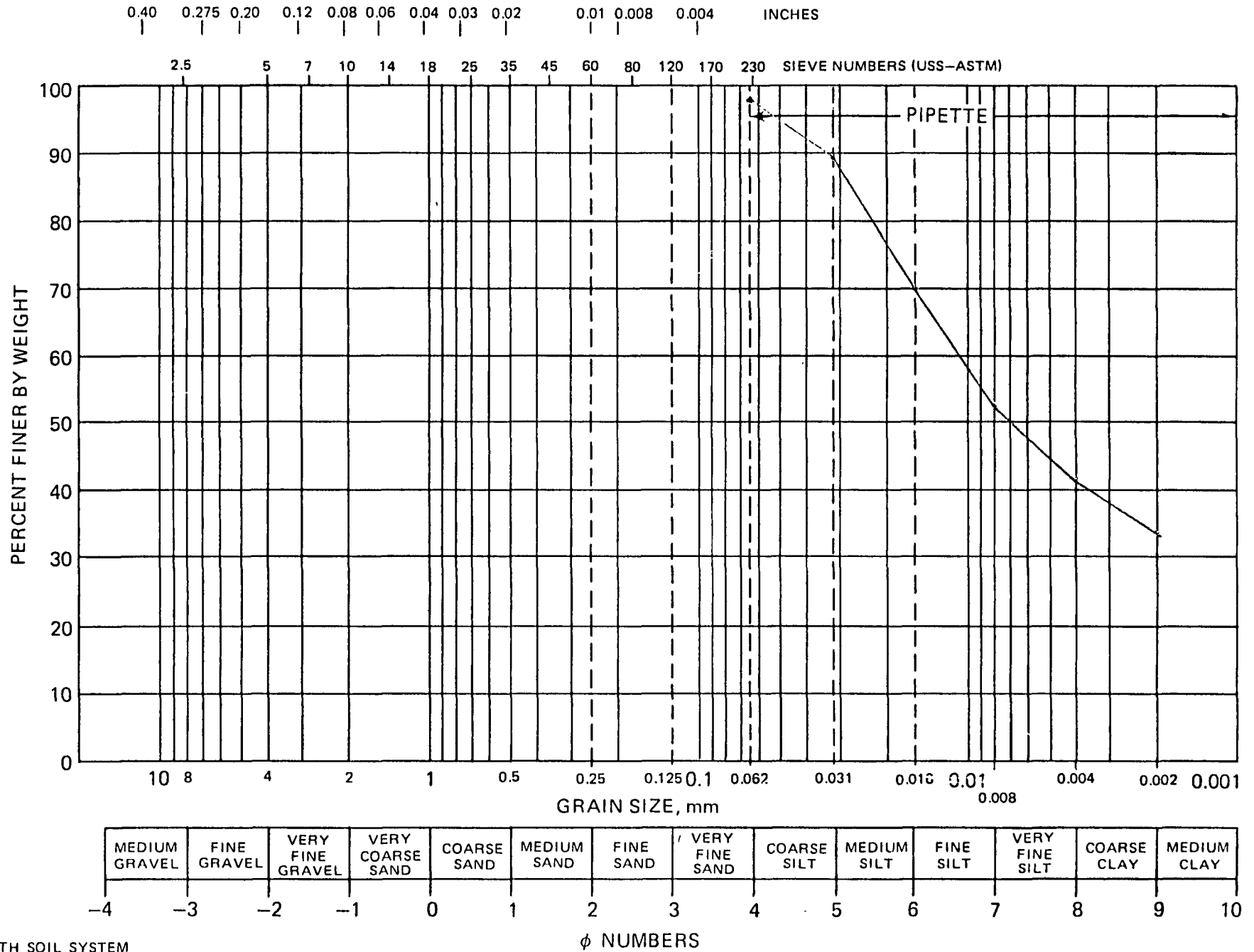
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ILLINOIS STATE WATER SURVEY

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WENTWORTH SOIL SYSTEM



GILSON SCREEN/SIEVE TEST REPORT



RETAINED							PASSING			NOTES	
WEIGHTS in. g kg lbs				PERCENT			SCREEN/SIEVE	WEIGHT	PERCENT		
Original + Screen	- Screen	+ Sample	Cumulative	Incremental	Cumulative	Spec	SIZE OR RANGE	Cumulative	Cumulative		Spec
							<0.075		97.47		1
							<0.150		77.11		2
							<0.300		40.05		3
							<0.600		52.70		4
							<1.180		41.55		5
							<2.000		34.06		6
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